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Evaluation of sinks and sources of CO2 in the global coastal ocean using a spatially-explicit typology of estuaries and continental shelves

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The exchange of CO_2 between the atmosphere and the global coastal ocean was evaluated from a compilation of air-water CO_2 fluxes scaled using a spatially-explicit global typology of inner estuaries (excluding outer estuaries such as large river deltas) and continental shelves. The computed emission of CO_2 to the atmosphere from estuaries (+0.27$\pm$0.23 PgC yr^{-1}) is $\sim$26% to $\sim$55% lower than previous estimates while the sink of atmospheric CO_2 over continental shelf seas (-0.21$\pm$0.36 PgC yr^{-1}) is at the low end of the range of previous estimates (-0.22 to -1.00 PgC yr^{-1}). The air-sea CO_2 flux per surface area over continental shelf seas (-0.7$\pm$1.2 molC m^{-2} yr^{-1}) is the double of the value in the open ocean based on the most recent CO_2 climatology. The largest uncertainty of scaling approaches remains in the availability of CO_2 data to describe the spatial variability, and to capture relevant temporal scales of variability.